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STREAM POLLUTION INVESTIGATION
SOURIS-DEVILS LAKE BASINS

PUBLIC HEALTH SERVICE
KANSAS CITY, MISSOURI

PREPARED FOR
BUREAU OF RECLAMATION
BILLINGS, MONTANA

JUNE 1950

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INTERIM REPORT
OF
STREAM POLLUTION INVESTIGATION
SOURIS-DEVILS LAKE BASINS

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16. Abstracts Water supply and water pollution in the Souris-Devils Lake area were studied in a cooperative effort by the Bureau of Reclamation and the Public Health Service. Preliminary data are given in this interim report, which also indicates the additional data to be collected during the investigation. The Souris-Devils Lake project proposes to provide a stream where no river previously existed, and to make available an adequate supply of good water where there has been only small, intermittent flows. The project affects areas of Montana, North Dakota, South Dakota, and Minnesota. Conclusions, which are subject to revision, are outlined regarding: (1) 14 public water supplies in the region; (2) augmentation and stabilization of ground water supply for individual homes and communities; (3) flow for dilution of treated sewage effluent; (4) increased population probability; (5) control of mosquitoes.

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INTERIM REPORT

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SOURIS-DEVILS LAKE BASINS

Prepared for

DEPARTMENT OF INTERIOR

BUREAU OF RECLAMATION

REGION 6

BILLINGS, MONTANA

By

FEDERAL SECURITY AGENCY, PUBLIC HEALTH SERVICE

DIVISION OF WATER POLLUTION CONTROL

MISSOURI DRAINAGE BASIN

KANSAS CITY, MISSOURI

JUNE 1950

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INTRODUCTION

In accordance with a Memorandum of Understanding between the Bureau of Reclamation and the Public Health Service, Federal Security Agency, which became effective March 20, 1950, this interim report of water pollution investigation on the Souris-Devils Lake area is submitted.

The purpose of the investigation is stated in the Memorandum of Understanding as follows: "The Bureau of Reclamation is now engaged in comprehensive development of the Missouri River Basin Project. In this connection, it is necessary to conduct public health studies in the Souris-Red River of the North Basins to secure data for use in providing for maximum water utilization as a part of the Missouri River Basin Project. This work is recognized as being significant and pertinent to the over-all Basin program and as such it is deemed the responsibility of the Bureau of Reclamation to assure its accomplishment. The work will include determinations of public health benefits from water releases and will pertain to uses of stored water for public health purposes, giving due recognition to potential revenues therefrom."

The study in accordance with the text of the Memorandum shall include: "(a) the extent, types, and major sources of pollution; (b) a review of existing laws and pending legislation regarding pollution of public waters in the States of Montana, North Dakota, and Minnesota; (c) minimum stream flows necessary for public water supplies and other miscellaneous purposes, and for sanitation purposes as related to present and possible future pollution; (d) quality of water for municipal requirements and other miscellaneous purposes; (e) public health benefits of water pollution abatement resulting from the conservation, regulation, and use of water supplies under the

Missouri River Basin program; (f) recommendations for pollution abatement and existing plans therefor; (g) effect of current and possible future pollution on water to be used for irrigation; and (h) other public health considerations of the water development program in the Basin."

The Missouri Drainage Basin Office of the Public Health Service has assigned two sanitary engineers to the North Dakota State Department of Health to collect data for the Missouri-Souris study. The engineers will devote full time to the study pending its completion.

The present report is limited to the analyses of existing data relating to water supply, pollution, and control in the Souris-Devils Lake area. The major objectives of this report are to give preliminary information as to water supply and water pollution in this region, to indicate the additional data to be collected during the investigation, and to present conclusions based upon existing information. The conclusions included in this report are subject to revision as additional information becomes available. The present report is submitted without opportunity of adequate review by interested Public Health Service officials or officials of the respective State Health Departments concerned with this project. This report is, therefore, indicated as preliminary and will be subject to revision by interested organizations.

CONCLUSIONS

The conclusions reached at this time are based upon considerations of the water development program in the Souris-Devils Lake region as it affects public health. These conclusions may be revised or corrected as more data becomes available.

1. At the present time there are 14 public water supplies in this region obtaining water from underground sources. There are several communities located downstream from Cheyenne Reservoir that obtain their water from surface supplies.

2. With this development the water for surface supplies will be improved in quantity and availability of sources. The effect of the development on water quality requires further study.

3. The ground water supply for individual homes and communities will be augmented and stabilized.

4. The development program may provide a more adequate and constant flow for dilution of treated sewage effluent.

5. The areas developed for intensive farming will bring new families and industries into the region. Satisfactory water supplies and sewage disposal facilities must be provided for these newcomers.

6. The control of mosquitoes must be considered in the development of this region.

7. Additional study is required to obtain the necessary information desired in this region.

DESCRIPTION

The Souris-Devils Lake Project of the Bureau of Reclamation proposes to divert water from the Missouri River at a point approximately four miles below the mouth of the Milk River into the Missouri Canal. Water would flow through the canal into Medicine Lake. The elevation of Medicine Lake would be raised by placing a dam across the Big Muddy Creek northwest of Culbertson, Montana. The water would then be pumped from Medicine Lake near Cremora, North Dakota and discharged into the Souris Canal. The

Souris Canal would distribute water through various laterals over the Crosby-Kenmare area. The des Lacs River would be impounded above Kenmare, North Dakota and incorporated into the distribution system. A collection canal would intercept the return irrigation water and divert it to the Souris River Diversion Dam. There the water would be conveyed through the Devils Lake Canal to the Sheyenne Reservoir, which is to be created by impounding the Sheyenne River downstream from Sheyenne, North Dakota. Water from the Sheyenne Reservoir will be diverted into the Devils Lake lateral thence into Devils Lake with the intent of raising the level of this lake. The water from Devils Lake will then flow into Stump Lake and into the Sheyenne River. The Sheyenne River is a tributary of the Red River of the North, entering the Red River in the vicinity of Fargo, North Dakota. In this manner supplemental flows may be obtained for the Red River of the North. It will also be possible to divert water from the Sheyenne Reservoir into the James River watershed. This will increase the flow in the James River and assist in further development of areas which have suffered in the past for lack of water. The above description covers only the main unit of the canal. There are several minor units planned in Montana, North Dakota and South Dakota which will be irrigated by water from this canal.

This project will have a far-reaching influence upon the residents of the region. The Souris-Devils Lake project virtually proposes to provide a stream where no river previously existed, and to make available an adequate supply of good water where there has been but small intermittent flows. It proposes to convert Devils Lake from a highly alkaline body of water with no drainage into a fresh water lake with a constant flow.

Much of the area served by the Souris-Devils Lake Project is glaciated with many small lakes or potholes. These small lakes have no outlet, hence much of the area does not contribute to the total runoff.

The climate is very severe, the mean annual temperature being as low as 39° F. in portions of the project. The growing season may be as short as 110 days. Temperatures of 50° F. below zero and lower have been experienced.

The area is rural in nature; no industries of consequence exist in the region at this time; the towns are small and located at a considerable distance from one another.

The area has supported dry-land farming for a period of approximately 50 years. With irrigation it can be anticipated that some of the area will be converted to more intensive farming, with attendant industries incidental to agricultural productivity. The project as contemplated will serve about 1.3 million acres of irrigable land in Montana and North Dakota by a combined system of gravity canals and pumping plants.

There are a total of 45 incorporated communities having populations of over 70 people in the area. These municipalities have a total population of 45,939 (1940 census).

SURVEY METHODS

The base data included in this report have been supplied primarily by the States concerned and various Government agencies. Water supply information has been obtained from the inventory prepared by the Environmental Health Center, Public Health Service. Information pertaining to the Souris-Devils Lake Project regarding its location and operation has been provided by the Bureau of Reclamation.

Public Water Supplies

There are 14 municipal water supplies in the Souris-Devils Lake area, all of which are obtained from ground sources (table 1 - appendix). These sources supply an estimated population of 35,500 people with water. It is possible that some communities may in the future utilize water from the Souris-Devils Lake Project to supply their drinking water needs.

Downstream from the Sheyenne River Dam, on the Sheyenne and James Rivers, and on the Red River of the North, there are several public water supplies which obtain water from surface sources. The development program will influence these supplies. Flow in Devils Lake Canal will be principally return irrigation water that may dissolve some of the soluble salts present in the soil. It may be anticipated that additional salts will be leached from the alkali beds created by Devils Lake. It is entirely probable that the water in the Sheyenne River and the Red River of the North will carry considerably larger quantities of dissolved solids than under normal conditions, and which may have an adverse effect upon the public supplies which use the streams for their source of water.

Private and public water supplies obtain their water from wells. It is anticipated that the ground water supplies will be stabilized by the development program as the ground water level will probably be raised throughout the region.

Sources of Pollution

There are 14 municipalities discharging wastes to streams of the region. The estimated population served totals 37,000 and known industrial wastes approximate 900 population equivalents. Treatment reduces the

pollution discharged by 26 percent to 27,500 population equivalents. Five communities discharge raw sewage; 7 have primary treatment facilities; and 2 provide secondary sewage treatment. These data are presented in table 2 - appendix.

In this study the sources of pollution can be classified into three categories, which are: (1) existing sources of pollution discharging into watercourses; (2) existing sources of pollution which discharge into land-locked areas; (3) new sources of pollution which will develop as a result of the new activity on the project.

The first source of pollution is probably the most serious, since these communities have been discharging their sewage either raw or with treatment into existing watercourses. Among these are Plentywood, Montana; Kenmare, Minot, Velva, Leeds, and Devils Lake, North Dakota. With the advent of the Missouri-Devils Lake project it is anticipated that uses of these streams will be greatly increased, such as for public water supplies and irrigation. During severe winter conditions the streams into which the sewage from one or more of these communities discharge have been known to freeze solid. With but a small flow and a very heavy ice cover the dissolved oxygen content may be depleted. With the Souris-Devils Lake development it is anticipated that the winter stream flows will be increased and thus provide adequate water for the dilution of treated sewage effluents. Plentywood, Montana will be discharging into an arm of the enlarged Medicine Lake. It will probably be necessary to provide treatment for this sewage before it is discharged into this quiescent body of water.

Communities in the second category include Crenora, Crosby, Bowbells, and Kenhall, North Dakota. These communities do not discharge

sewage to a stream at the present time. The disposal of sewage from these communities must be very carefully considered in light of the canals which will go through or near these towns, with the idea of preventing disease organisms from the communities reaching the water in the irrigation canals.

The third category of pollution, that from new sources created by the irrigation project, will probably be the easiest of all to control. Such industries or newly developed communities may be located and laid out with proper waste disposal as an objective. Such waste disposal must first be approved by the State, with approval based upon conditions existent in the area and the effect of the sewage upon the over-all project.

DISCUSSION

The investigation to date has been confined to the assembly and tabulation of available data, and any interpretation must be considered preliminary pending the collection of more comprehensive information. Existing records of water supply and principal sources of pollution have been presented in tables 1 and 2 in the appendix.

Normally the prime consideration in any discussion of desirable stream flows is the matter of public water supply. However, all communities in the Sourie-Devils Lake area secure their water from ground sources, though it is possible that future demands may necessitate a dependence upon streams for many public water supplies.

In considering the matter of desirable flows from the standpoint of pollution abatement, the basic assumption is made that pollution problems will be corrected either because of State action for the protection of public health, because of damage suits, or to fulfill the demand for clean streams. The degree of sewage treatment will depend upon the

magnitude of the source of pollution in relation to the flow in the stream. It is assumed that a minimum of primary treatment will be provided by all communities. If it is found that primary treatment is insufficient, due to low stream flows, secondary or a higher degree of treatment may be required. In the latter situation it may be possible through increased flows to construct a partial treatment plant, thus reclaiming a polluted stream at lesser cost. The savings from such a procedure can justifiably be credited as a benefit to the increased flow. No degree of flow increase can entirely eliminate the need for treatment as a minimum of primary treatment is needed to prevent sludge deposits and to eliminate objectionable floating material.

The development of desirable flows presumes a minimum dissolved oxygen content of 5 p.p.m. and a minimum of primary treatment unless the existing treatment is of a higher efficiency. Minimum desirable flows for sanitation purposes at Minot, North Dakota, the largest source of pollution in this Sub-Basin, have been estimated as follows: June through September - 42 c.f.s., November through March - 100 c.f.s., April, May and October - 20 c.f.s. Ice cover with accompanying restriction on stream reaeration is reflected in the 100 c.f.s. required during the winter season. It is to be stressed that the estimates have been formulated in the absence of much essential data and with numerous assumptions based solely on professional judgment. It must be fully understood that since estimated flows as given are preliminary in nature, and accurate only in general range of magnitude, they are subject to revision when additional information and data are available to support more precise calculations.

APPENDIX

Table 1. Water Supply Data

Community	State	County	Water Supply: Population served	Water Supply: Source of Supply	Water Supply: Treatment
Wolf Point	Montana	Roosevelt	1,600	Drilled wells	Chlorination
Poplar	"	"	600	Drilled and dug wells	None
Plentywood	"	Sheridan	1,000	Drilled wells	Softening and Chlorination
Cremora	No. Dakota	Williams	400	Dug well	None
Crosby	"	Divide	1,400	Dug & drilled wells	None
Noonan	"	"	450	Drilled well	None
Bowbells	"	Burke	300	Drilled wells	None
Kenmare	"	Ward	1,000	Drilled well	None
Minot	"	"	15,400	Drilled wells	None
Velva	"	McHenry	900	Springs	None
Mohall	"	Renville	500	Drilled wells	None
Harvey	"	Wells	1,500	Drilled well	None
Leeds	"	Benson	500	Drilled wells	None
Devils Lake	"	Ramsey	5,000	Artesian well	None
			35,530		

Table II. Sources of Pollution

Community	State	County	River Mileage	Receiving stream and tributaries	Population 1940	Pollution Population served	Pollution Industrial waste population equivalent	Pollution Total population equivalent, untreated waste
Wolf Point	Montana	Roosevelt	1302	Missouri	1900	1500	50 Milk plant	1547
Poplar	"	"	1775	Missouri	1442	1900		1900
Plentywood	"	Sheridan	1725	Missouri				
			99	Big Muddy	1574	1200	50	1250
Froid	"	Roosevelt	40	Big Muddy Sheep Creek	441	0		
Grenora	No. Dakota	Williams		Landlocked	435	600		600
Crosby	"	Divide		Souris River Long Creek	1404	2000		2000
Noonan	"	"		Long Creek	520	600		600
Larson	"	Burke			79	0		
Columbus	"	"			906	0		
Lignite	"	"			235	0		
Portal	"	"			499	0		
Flaxton	"	"		Souris River des Lacs River	362	0		
Bowbells	"	"		" " "	737	200		200
Kenmare	"	Ward		" " "	1521	1700	300	2000
Dunnybrook	"	"		" " "	215	0		
Carpio	"	"		" " "	322	0		
Northold	"	"		" " "	421	0		
Des Lacs	"	"		" " "	197	0		
Tolley	"	Renville		Souris River	177	0		
Minot	"	Ward		" "	16977	15000		
Sawyer	"	"		" "	271	0		
Velva	"	McHenry		" "	1017	1500	500	2000
Voltaire	"	"		" "	101	0		
Sherwood	"	Renville		Deep River	300	0		

APPENDIX

	River Mileage	Receiving stream and tributaries	Population 1940	Pollution information: Population served	Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment given	Percent removal	Total population equivalent discharged to stream
t	1802	Missouri	1900	1500	50 Milk plant	1547	None		1547
	1775	Missouri	1442	1900		1900	Primary	20	1500
	1725	Missouri							
	99	Big Muddy	1574	1200	50	1250	None		1250
t	40	Big Muddy							
		Sheep Creek	441	0					
		Landlocked	425	600		600	Primary		Does not reach stream
		Souris River							
		Long Creek	1404	2000		2000	Ponding		Does not reach stream
		Long Creek	520	600		600	Primary	33	Landlocked
			79	0					
			506	0					
			235	0					
			499	0					
		Souris River							
		Des Lacs River	362	0					
		" " "	707	200		200	Primary		Land application
		" " "	1523	1700	300	2000	None		2000
		" " "	215	0					
		" " "	322	0					
		" " "	423	0					
		" " "	197	0					
s		Souris River	177	0					
		" "	16577	15000			Secondary	33	10000
		" "	271	0					
		" "	1017	1500	500	2000	None		2000
		" "	101	0					
o		Deep River	300	0					

Table II. Sources of Pollution (cont'd.)

Community	State	County	River Mileage	Receiving stream and tributaries	Population 1940	Population served	Pollution I: Industrial waste population equivalent	Pollution I: Total population equivalent, untreated waste
				Deep River				
Loraine	No. Dakota	Renville		Spring Coulee	74	0		
Mohall	"	"		" "	607	200		800
Lansford	"	Bottineau		" "	300	0		
Glenburn	"	Renville		" "	190	0		
Deering	"	McHenry		Little Deep River	140	0		
				Souris River				
Granville	"	"		Collection Canal	443	0		
				Devils Lake Canal		0		
Karlsruhe	"	"		Mintering River	239	0		
				Sheyenne River				
Esmond	"	Benson		Branch	449	0		
Martin	"	Sheridan			223	0		
Harvey	"	Wells		Sheyenne River	1951	2000		
Maddock	"	Benson		Branch	691	0		
Sheyenne	"	Eddy		Sheyenne River	431	0		
Minnewaukan	"	Benson		Devils Lake	521	0		
Brinsmade	"	"		Branch Creek	206	0		
Mylo	"	Rolette		Branch Stream	89	0		
Leeds	"	Benson		" "	732	1000		1000
Church's Ferry	"	Ramsey		" "	244	0		
Devils Lake	"	"		Devils Lake	6204	7000		7000
Crary	"	"		Branch	267	0		
Warwick	"	Benson		Sheyenne River	224	0		
Tolna	"	Nelson		" "	172	0		
					45,939	37,000		

nt'd.)

River Mileage	Receiving stream and tributaries	Population 1940	Population served	Pollution Information: Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment given	Percent removed	Total population equivalent discharged to stream
	Deep River							
	Spring Coulee	74	0					
	" "	607	800		800	Primary		Does not reach water course
	" "	300	0					
	" "	190	0					
	Little Deep River	140	0					
	Souris River							
	Collection Canal	443	0					
	Devils Lake Canal		0					
	Wintering River	289	0					
	Sheyenne River							
	Branch	449	0					
		223	0					
	Sheyenne River	1351	2000			None		2000
	Branch	691	0					
	Sheyenne River	432	0					
	Devils Lake	521	0					
	Branch Creek	206	0					
	Branch Stream	89	0					
	" "	732	1000		1000	Secondary	80	200
	" "	244	0					
	Devils Lake	6804	7000		7000	Primary	0	7000
	Branch	267	0					
	Sheyenne River	224	0					
	" "	172	0					
		45,930	37,000					27,200

Table II. Sources of Pollution

Community	State	County	River Mileage	Receiving stream and tributaries	Population 1940	Pollution Info: Population served	Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment
Wolf Point	Montana	Roosevelt	[illegible]	Missouri	1900	1500	50 Milk plant	1547	None
Poplar	"	"	1775	Missouri	1442	1900		1900	Primary
Plentywood	"	Sheridan	1785	Missouri	1574	1200	50	1250	None
			99	Big Muddy					
Froid	"	Roosevelt	40	Big Muddy					
				Sheep Creek	442	0			
Grenora	No. Dakota	Williams		Landlocked	425	600		600	Primary
Crosby	"	Divide		Souris River				2000	Pond
				Long Creek	1404	2000			
	"	"		Long Creek	500	600		600	Primary
Noonan	"				79	0			
Lignite	"	Burke			500	0			
Columbus	"	"			835	0			
Lignite	"	"			499	0			
Powers	"	"		Souris River					
				des Lacs River	342	0			
[illegible]	"	"		" " "	737	200		200	Primary
[illegible]	"	"		" " "	[illegible]	1700	300	2000	None
[illegible]	"	Ward		" " "	215	0			
[illegible]	"	"		" " "	322	0			
[illegible]	"	"		" " "	421	0			
[illegible]	"	"		" " "	197	0			
Des Lacs	"	"		Souris River	177	0			
Foley	"	Renville		" "	14977	15000			Septic
Minot	"	Ward		" "	[illegible]	0			
[illegible]	"	"		" "	1017	1500	500	2000	None
Velva	"	McHenry		"	108	0			
Tolstoire	"	"							
Sherwood	"	Renville		Deep River	390	0			

APPENDIX

ty	River Mileage	Receiving stream and tributaries	Population 1940	Pollution Information: Population served	Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment given	Percent removed	Total population equivalent discharged to stream
vale	[illegible]	Missouri	1900	1500	50 Milk plant	1547	None		1547
	1775	Missouri	1442	1900		1900	Primary	20	1500
lan	1775	Missouri							
	99	Big Muddy	1574	1200	50	1250	None		1250
vale	40	Big Muddy							
		Sheep Creek	442	0					
ms		Landlocked	425	600		600	Primary		Does not reach stream
e		Souris River							
		Long Creek	1404	2000		2000	Ponding		Does not reach stream
		Long Creek	538	600		600	Primary	33	Landlocked
			79	0					
			506	0					
			235	0					
			499	0					
		Souris River							
		des Lacs River	362	0					
		" " "	737	200		200	Primary		Land application 2000
		" " "	[illegible]	1700	300	2000	None		
		" " "	215	0					
		" " "	322	0					
		" " "	431	0					
		" " "	197	0					
lle		Souris River	177	0					
		" "	[illegible]	15000			Secondary	33	10000
		" "	671	0					
		" "	1017	1500	500	2000	None		2000
		" "	103	0					
lle		Deep River	390	0					

Table II. Sources of Pollution (cont'd.)

Community	State	County	River Mileage	Receiving stream and tributaries	Population 1940	Population served	Pollution Information: Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment
				Deep River					
Lorraine	No. Dakota	Nelville		Spring Coulee	74	0			
Mohall	"	"		" "	607	300		300	Prim
Lansford	"	Bottineau		" "	300	0			
Glenburg	"	Renville		" "	190	0			
Deering	"	McHenry		Little Deep River	140	0			
				Souris River					
Granville	"	"		Collection Canal	443	0			
				Devils Lake Canal		0			
Karlsruhe	"	"		Wintering River	209	0			
				Sheyenne River					
Esmond	"	Benson		Branch	449	0			
Martin	"	Sheridan			221	0			
Harvey	"	Wells		Sheyenne River	1951	2000			Sewe
Maddock	"	Benson		Branch	692	0			
Sheyenne	"	Eddy		Sheyenne River	432	0			
Minnewaukan	"	Benson		Devils Lake	591	0			
Brinsmade	"	"		Branch Creek	206	0			
Hyde	"	Rolette		Branch Stream	89	0			
Leeds	"	Benson		" "	732	1000		1000	Seco
Churches Ferry	"	Ramsey		" "	244	0			
Devils Lake	"	"		Devils Lake	6204	7000		7000	Prim
Crary	"	"		Branch	267	0			
Minnewaukan	"	Benson		Sheyenne River	591	0			
Tolna	"	Nelson		" "	172	0			
					45,900	37,000			

(cont'd.)

County	River Village	Receiving stream and tributaries	Population 1940	Pollution Information: Population served	Industrial waste population equivalent	Total population equivalent, untreated waste	Treatment given	Percent removal	Total population equivalent discharged to stream
		Deep River							
ville		Spring Coulee	74	0					
"		" "	607	300		300	Primary		Does not reach water course
inam		" "	300	0					
ville		" "	190	0					
ary		Little Deep River	140	0					
		Souris River							
		Collection Canal	443	0					
		Devils Lake Canal		0					
		Wintering River	289	0					
		Cheyenne River							
on		Branch	449	0					
rden			221	0					
le		Cheyenne River	1051	2000			None		2000
on		Branch	691	0					
y		Cheyenne River	432	0					
on		Devils Lake	501	0					
"		Branch Creek	200	0					
tte		Branch Stream	89	0					
on		" "	732	1000		1000	Secondary	80	200
ey		" "	244	0					
"		Devils Lake	6204	7000		7000	Primary	0	7000
"		Branch	267	0					
on		Cheyenne River	201	0					
on		" "	172	0					
			45,930	37,000					27,500